Numerical experiments using ice sheet models on the ice-ocean inteaction and stability of Antarctic Ice Sheet

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Ice-ocean interaction in the Antarctica is of importance for the stability of Antarctic Ice Sheet. Sea level rise and its rate due to deglaciation northern hemispheric ice sheets (Ritz et al., 2001, Goelzer et al., 2016), increased basal melting of ice shelves due to warming in seawater temperature around Antarctica has proposed as important mechanism to retreat Antarctic Ice Sheet, and glacial meltwater release from Antarctic ice sheet as a possible amplifying mechanism by enhanced stratification in the Southern Ocean and warmed subsurface ocean (Golledge et al., 2014). The rate of basal melting beneath ice shelf is determined by seawater temperature below ice shelves, but this seawater temperature is often different from that in the subsurface Southern Ocean because of sea ice production in the Antarctic Coast and associated cold and dense shelf water formation (Obase et al., submitted). Previous ice sheet modeling studies, however, lack representation in this physical process because they use subsurface seawater temperature in the Southern Ocean directly to parameterize the rate of basal melting of ice shelves. In this study, we make a parameterization of basal melting which is able to apply ice sheet models, based on model experiments using a regional ocean model and an atmosphere-ocean coupled GCM. We perform 2-d ice sheet model experiments to investigate fundamental behavior of ice sheet-ice shelf system to forcings of ocean-induced basal melting and sea level rise and to quantify the relative importance of external conditions on the threshold of Antarctic ice sheet retreats.

Keywords: Antarctic Ice Sheet, Southern Ocean, Antarctic ice-ocean interaction, Ice shelf

